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# A comparison of several methods of macular hole measurement using OCT and their value in predicting anatomical and visual outcomes

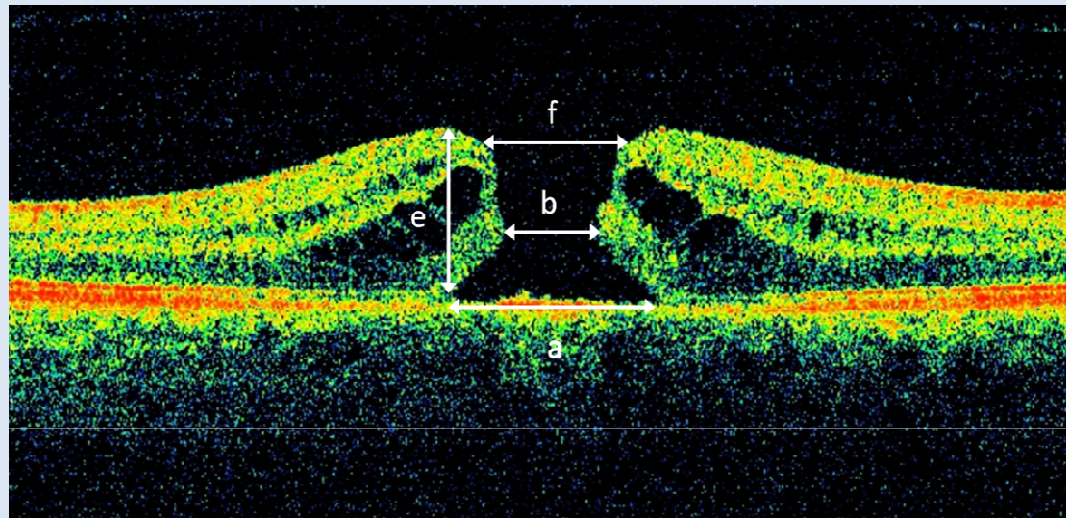
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BEAVRS 10<sup>th</sup> November 2011

# Background



a = base diameter

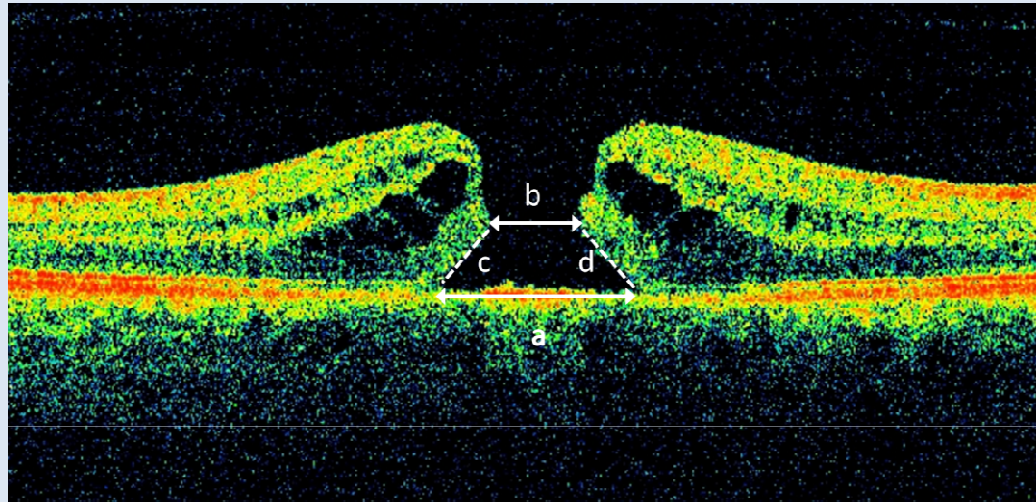
b = minimum linear dimension (MLD)<sup>1</sup>

e = maximal hole height

f = macular hole inner opening

1. Ip MS, Baker BJ, Duker JS, Reichel E, Bauman CR, Gangnon R, Puliafito CA. [Anatomical outcomes of surgery for idiopathic macular hole as determined by optical coherence tomography](#). Arch Ophthalmol. 2002 Jan;120(1):29-35.

# Hole Form Factor (HFF)<sup>2</sup>



Determine extent of Base diameter (a) and MLD (b)

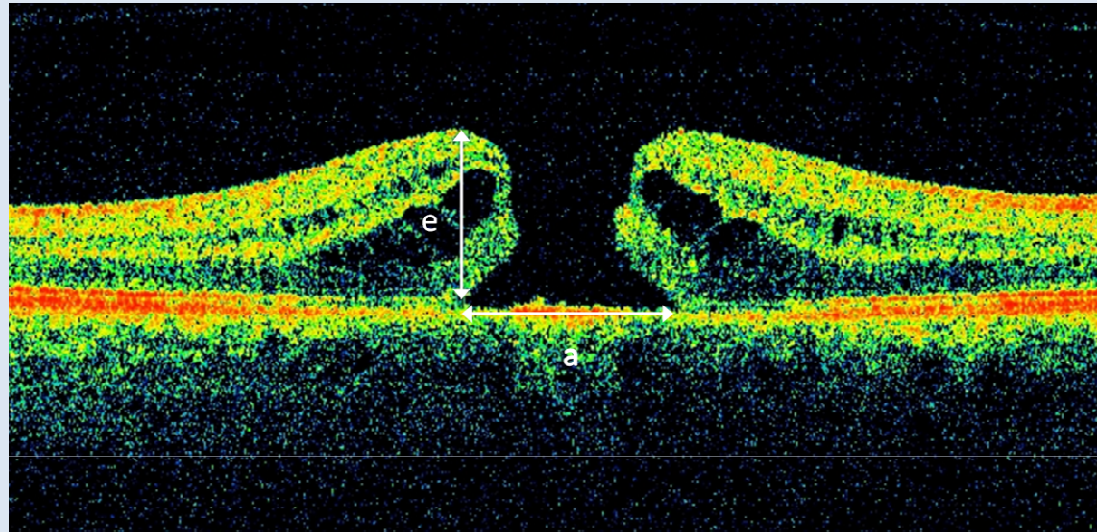
Hole Form Factor =  $(c + d) / a$

No correlation found between HFF and postop gain in lines

2. Ullrich S, Haritoglou C, Gass C, Schaumberger M, Ulbig MW, Kampik A. [Macular hole size as a prognostic factor in macular hole surgery](#). Br J Ophthalmol. 2002 Apr;86(4):390-3.



# Macular Hole Index (MHI)<sup>3</sup>

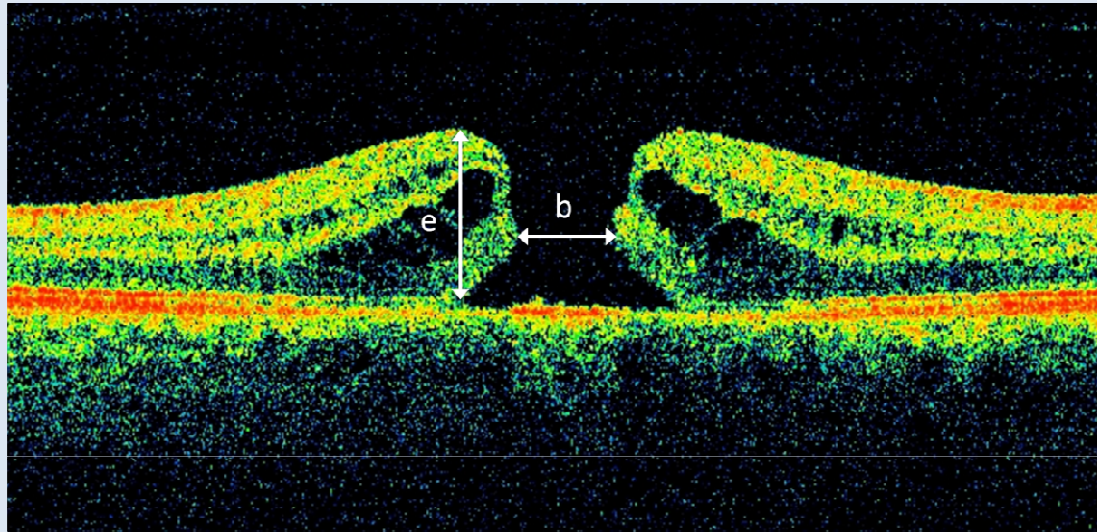


$$\text{MHI} = e / a$$

MHI was associated with postoperative vision

3. Kusahara S, Teraoka Escaño MF, Fujii S, Nakanishi Y, Tamura Y, Nagai A, Yamamoto H, Tsukahara Y, Negi A. [Prediction of postoperative visual outcome based on hole configuration by optical coherence tomography in eyes with idiopathic macular holes.](#) Am J Ophthalmol. 2004 Nov;138(5):709-16.

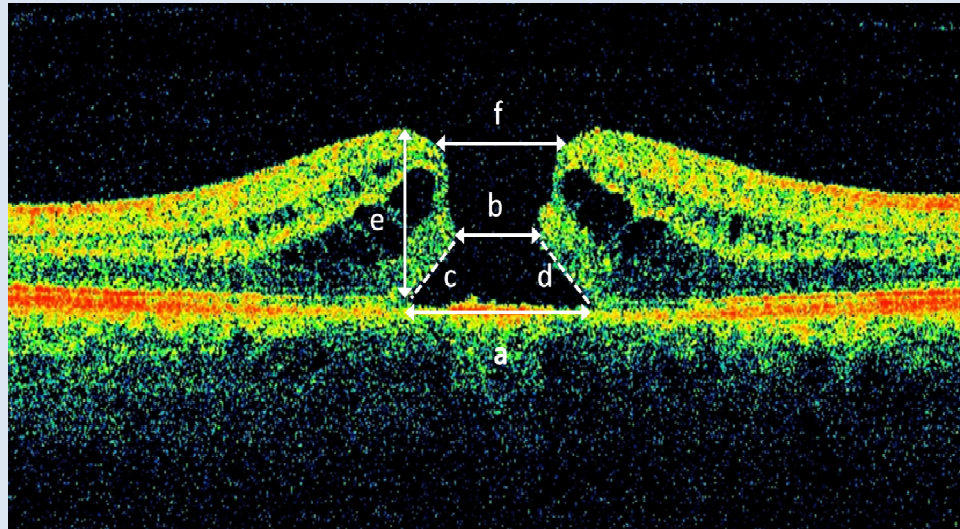
## Tractional Hole Index (THI)<sup>4</sup>



$$\text{THI} = e/b$$

THI correlated significantly with postop vision

4. Ruiz-Moreno JM, Staicu C, Piñero DP, Montero J, Lugo F, Amat P. [Optical coherence tomography predictive factors for macular hole surgery outcome](#). Br J Ophthalmol. 2008 May;92(5):640-4.



## Basic measurements

- Base diameter (a)
- Minimum linear dimension (b)
- Hole height (e)
- Macular hole inner opening (f)

## Derived indices

- Hole Form Factor  $(c+d/a)$
- Macular Hole Index  $(e/a)$
- Tractional Hole Index  $(e/b)$

# Study

- Prospective consecutive case series study of 50 eyes from 50 patients, May '09 – Jan '11
- Idiopathic Stage II (n=8), Stage III (n=38) or Stage IV (n=4) macular hole
- 23-gauge vitrectomy, phaco + IOL, ILM peel with Brilliant Blue G staining and endotamponade with 20% SF<sub>6</sub>
- No special posturing
- One pseudophake, no significant cataract

# Outcome measures

- **Anatomical success:**  
Complete circumferential hole rim reattachment without foveal neurosensory retinal defect demonstrated on OCT
- **Visual success:**  
Gain of two or more Snellen lines at up to a year postop
- Discharged at 3 months if 6/12 achieved, or at 1 year postop
- All patients whose macular holes had failed to close were successfully closed with further surgery

# Results

- 84% (42/50 eyes) achieved macular hole closure
- 76% (38 eyes) achieved  $\geq 2$  lines improvement in Snellen acuity
- Binary logistic regression analyses:
  - anatomical success (hole closure Y / N)
  - visual success (2 lines gained Y / N)

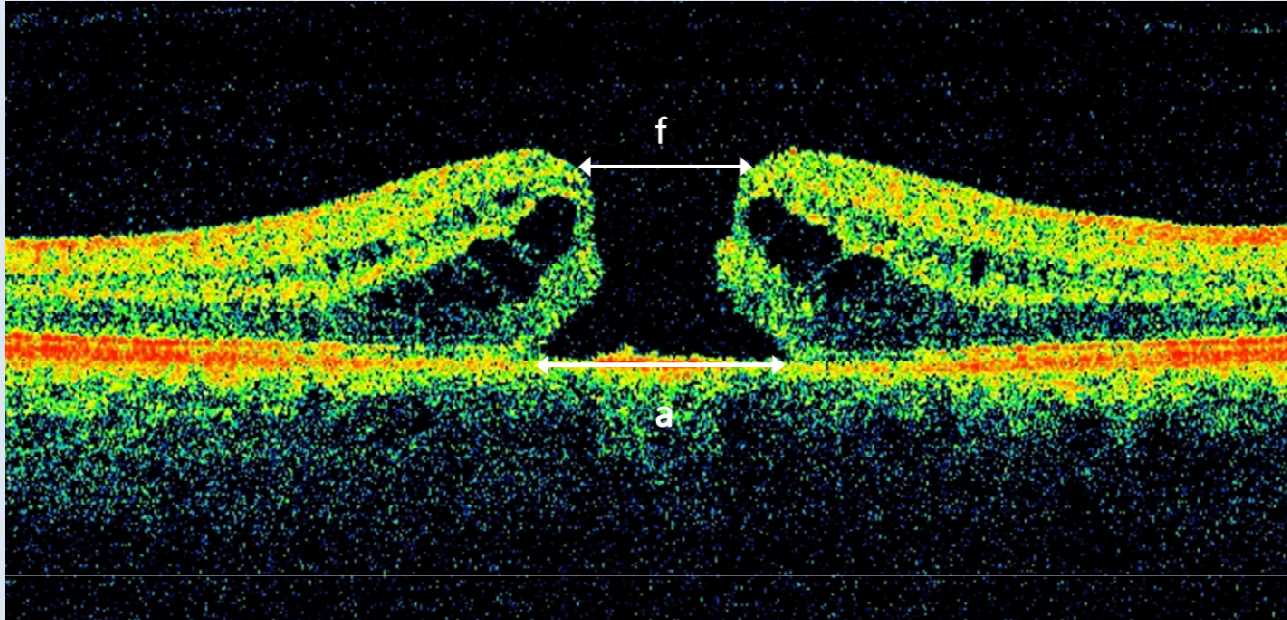


# Assessment of variables associated with anatomical success

Parameter	p-value	Odds ratio	95% CI for odds ratio	Area under ROC curve	95% CI for area under ROC curve
Age	0.642	0.975	(0.877, 1.084)	0.539	(0.317, 0.760)
Sex					
Male - reference category	0.616	0.643	(0.114, 3.610)	0.546	(0.331, 0.760)
Female					
Axial length (mm)	0.473	0.789	(0.412, 1.510)	0.555	(0.330, 0.780)
* Base diameter (μm)	0.005	0.992	(0.987, 0.998)	0.929	(0.848, 1.000)
* MH inner opening (μm)	0.002	0.984	(0.973, 0.994)	0.943	(0.873, 1.000)
* Min Linear Dimension (μm)	0.002	0.990	(0.984, 0.997)	0.859	(0.735, 0.982)
Hole height (μm)	0.104	0.992	(0.981, 1.002)	0.679	(0.436, 0.922)
* Macular Hole Index	0.006	7.390 <sup>1</sup>	(1.757, 31.09) <sup>1</sup>	0.909	(0.821, 0.998)
Tractional Hole Index	0.065	1.279 <sup>1</sup>	(0.985, 1.660) <sup>1</sup>	0.708	(0.517, 0.899)

# Assessment of variables associated with visual success

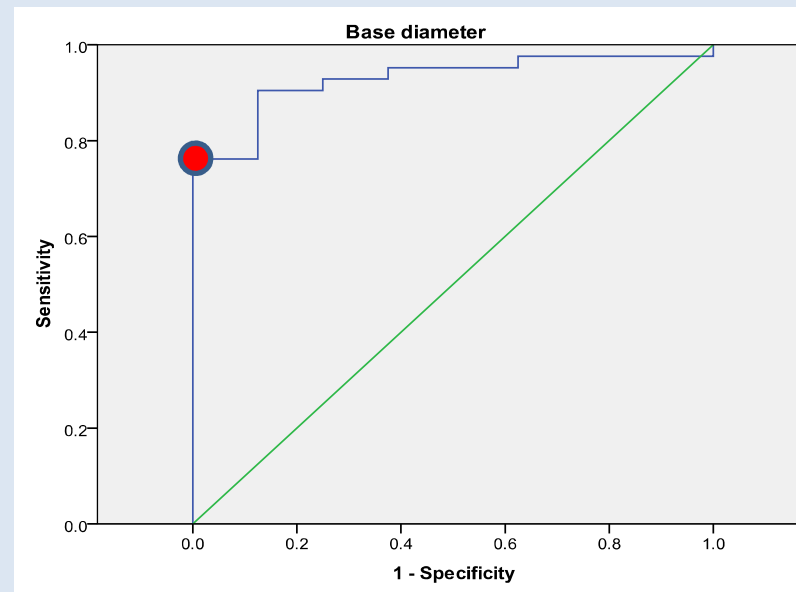
Parameter	p-value	Odds ratio	95% CI for odds ratio	Area under ROC curve	95% CI for area under ROC curve
Age	0.378	0.959	(0.873, 1.053)	0.565	(0.391, 0.738)
Sex	0.954	1.042	(0.261, 4.155)	0.505	(0.314, 0.619)
<i>Male - reference category</i>					
<i>Female</i>					
Axial length (mm)	0.703	0.892	(0.495, 1.607)	0.542	(0.359, 0.724)
* <b>Base diameter (μm)</b>	<b>0.013</b>	<b>0.996</b>	<b>(0.993, 0.999)</b>	<b>0.776</b>	<b>(0.605, 0.947)</b>
* <b>MH inner opening (μm)</b>	<b>0.013</b>	<b>0.993</b>	<b>(0.987, 0.998)</b>	<b>0.761</b>	<b>(0.591, 0.931)</b>
* <b>Min Linear Dimension (μm)</b>	<b>0.018</b>	<b>0.994</b>	<b>(0.990, 0.999)</b>	<b>0.717</b>	<b>(0.540, 0.894)</b>
Hole height (μm)	0.281	0.996	(0.998, 1.004)	0.579	(0.379, 0.779)
Macular Hole Index	0.091	1.510	(0.937, 2.433)	0.782	(0.608, 0.955)
Tractional Hole Index	0.178	1.130	(0.946, 1.350)	0.615	(0.437, 0.793)



$a$  = Base diameter

$f$  = Macular hole inner opening

Receiver Operating Characteristic (ROC) curve for anatomical success using the Base Diameter parameter



- A base diameter value of 747μm corresponds to 76.2% sensitivity and 100% specificity ●
- 10% reduction in the odds of anatomical success for every 13μm increase in base diameter

Thank you